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WE

November-December 1981

WE People

A colorful hobby brightens children's holidays

Addie McGuire, who works in the special purpose telephone apparatus department at the Indianapolis Works, has been crocheting dolls' clothing for the Christmas dress-a-doll program for 17 years. Last year she crocheted 51 dolls' outfits and she plans to create even more this year. The dolls are donated by charitable agencies and Addie and her co-workers at Indianapolis return the dolls clothed. They work during breaks and at lunch, but mostly at home in the evening while watching TV.

Over the years, Addie estimates that she has dressed more than 600 dolls. The Indianapolis group has dressed more than 1,000 dolls and donated more than 2,000 new toys for the program.

When the dress-a-doll project started at the Works, Addie did not know how to crochet. In the early years she sewed the outfits for the male and female dolls.

"In 1974," Addie says, "when I was named the chairman of the project, we had so many dolls that had not been picked up that I started to crochet to help dress all of them. Several women helped by making part of the outfit, like the dress or the booties. We combined all our pieces to make a complete outfit for each doll and dressed about 100 dolls that year.

"One day last December," she continues, "when I was crocheting an outfit, I timed myself. It took me 2½ hours to crochet a dress, hat, panties, and booties for a doll. That time included sewing on the buttons. Ten years ago, it took me 3½ hours to crochet that much."

Addie never uses a pattern, no matter what she crochets. As long as she has the doll in front of her, she can create the outfit. Her favorite outfit was one she crocheted in red for twin male and female dolls.

After the dress-a-doll project, Addie does not put down her crochet hooks. She has recently crocheted 2,000 roses for afghans. She explains, "A king-sized afghan takes 196 rose patterns."

Until several years ago, Addie crocheted Christmas stockings for sale. She used the profits to buy candy for Muscatatuck State Hospital for the mentally retarded and physically handicapped. The Pioneers go to the hospital four times a year to entertain in a special unit that is assigned by the hospital.

If thank-you notes were received for the dolls donated by the Indianapolis Works, Addie McGuire and many others certainly deserve a tall stack of mail. A doll wearing a handmade outfit is a very special gift and one that not too many children are fortunate enough to receive. WE

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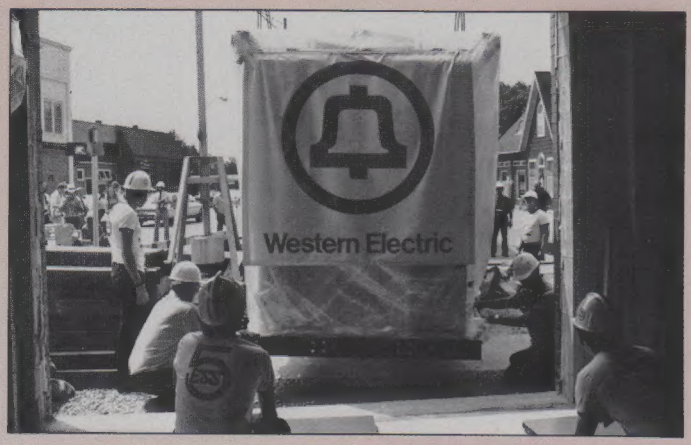

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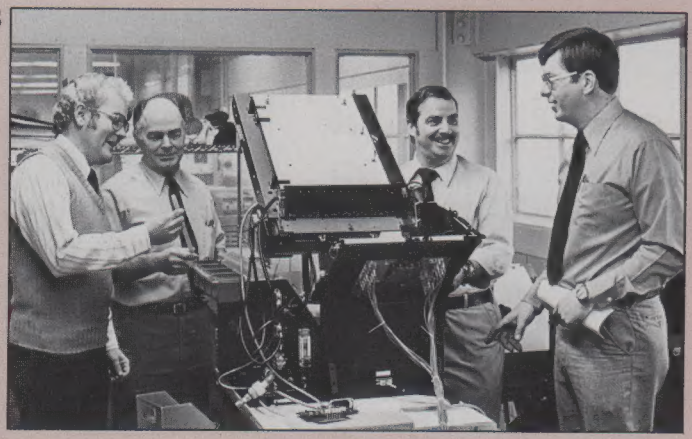

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Western Electric

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ON THE COVER: WE's first No. 5 ESS is installed and Mary Austerlade was there. An engineer working out of the Rolling Meadows Regional Center, Mary and her group were responsible for the tooling needed to dismantle the steel framework in which the No. 5 was shipped as well as for the air pallets on which the system was moved from the truck into the building. Mary was on hand on the big day to observe and handle any problems that came up. None did. Story begins on page 2.

Photo by Joseph Gazdak


Here Comes the
COMING TO SENECA, ILL.
WESTERN ELECTRIC №5 DIGITAL ESS
ELECTRONICS
EXHIBITS

No.5

By George Gray

"It's a first," said somebody in the crowd, "and that makes it exciting." She was watching the installation of our first No.5 ESS

Seneca, Illinois, on Wednesday, July 1, 1981, was a happening. That was the day a huge North American Van Lines truck arrived, carrying a brand new switching machine—our No. 5 ESS—for the Illinois Bell Telephone office on Main Street.

The action started promptly at seven A.M. when barricades were put up across the side street and around the spot where workmen were opening a hole in one wall of the telephone building. Crowds of curious townspeople gathered on the sidewalk across the street long before the truck arrived at nine.

Out in the middle of Main Street, trying to keep a steady stream of traffic moving, Police Chief Mike Fowler said, "Busiest day we've had around here in 12 years." He used to be a long-distance trucker himself in an earlier career, and he admired the skill of the driver of the van in jockeying it into position.

"I used to be the whole force," Chief Fowler said. "Now I've got two full-time deputies plus four part timers. We've got a new truck terminal at the east end of town and a big atomic plant under construction about four miles farther on. We're getting more traffic all the time."

People are friendly in the Midwest. One fellow with a deep tan from working in the fields, sat down on the curb next to us. "I didn't know anything about a new telephone office," he said, "till I came in town and saw the big crane."

"There really wasn't a great deal of publicity in advance," said Village Clerk Jean Martin in the village office on Williams Street. "I don't know exactly what it's going to mean," she went on, "but it's supposed to make possible a lot of innovations. Most of the townspeople weren't aware that it was coming. Of course, we heard about it in here through Hazel, whose husband works for Illinois Bell. He stopped by about getting the road blocked off." Hazel's husband turned out to be Jack Belden, in charge of some seven CDOs (community dial offices) in the area.

We chatted briefly with a lot of townspeople, asking about the area and what the new office meant to them. Two housewives, Evelyn Hollenbeck and Edith Brockman, said they didn't know too much about

Above — Seneca residents Evelyn Hollenbeck and Edith Brockman chat while watching the No. 5 ESS unloaded. Left — The van turning into Main St.

electronic switching, although they had read the article in the local newspaper. "I knew when they put on the addition a year ago and left that one part cement block that they weren't finished," said one. "It's a first," the other summed up, "and that makes it exciting."

The women told us that there was no industry in town. There is a Du Pont plant a few miles away that makes agricultural chemicals and Commonwealth Edison is building a big atomic power plant on the far side of the Illinois River. They were proud of the new high school and two marinas on the edge of town. The main crops in the area are corn and soybeans. Farms range in size from 80 to several hundred acres, and kids come in by bus from up to ten miles away to go to school. Population at the last census was 2,098.

"Amazing how the human mind can dream up a complicated machine like that," one senior citizen said to his friend, leaning against the ledge of a photo shop window.

The new switch, which is a series of 18 equipment frames painted blue and white and bolted top and bottom to a sturdy metal frame as a 13,600-pound unit, was slid out of the van on air pallets. "It takes only 19 pounds of pressure to move it," said John Sears, a member of the Northern Illinois Works team handling the move. "It's so smooth, in fact, it's scary."

The big orange crane took over as the package came out of the truck, and lowered it in stages to ground level where it could then be slid again on air pallets into the building. "The tricky part is over once you get the sling hooked in four positions," said Jack Garrett, Director of Engineering and Manufacturing from Northern Illinois Works.

Across the street the sidewalk superintendents were applying a lot of long distance body English as the huge package inched toward the gaping hole in the side of the telephone building, past the town's memorial flagpole.

"We really didn't want them to take out the flagpole with Saturday being the Fourth of July," Chief Fowler said, "and they claimed they had just enough room." And they did—with about an inch to spare.

The landmark that you can see farthest away as you drive through

the cornfields toward town from Interstate 80 is a big green watertower. It proclaims in huge white letters: "Seneca, Home of the Fighting Irish."

Bonnie Peterson, owner of the real estate office on Main Street, who used to drive 45 miles each way to work at our Montgomery Plant, is a lifelong resident but could not account for either the town's name or slogan.

"The town used to be called Crotty," Mrs. Peterson said, "but some years ago—before my time—it was changed officially to Seneca, probably at the time of the Centennial. I really don't know why. The Seneca Indians lived in New York State—not anywhere near here. But most of the towns in this part of the state are named for Indian tribes and to fit the pattern, I guess, we became Seneca."

Jack Warner of Bell Labs, one of the designers of the system, answered our question about why Seneca was selected for the No. 5 ESS. "It was an economic decision," he said. "The telephone company selected the site closest to Bell Labs at Indian Hill."

And he also summed up what a lot of others felt. "I've been working on this project from the beginning and I've been involved in a lot of things like measuring the flagpole to see if we could get in around it. But I felt a real emotional tug when I got out here today and saw it slide in so beautifully."

The No. 5 ESS is the latest in the series of stored program controlled switches designed by Bell Labs and manufactured by Western Electric. A unique characteristic of the No. 5 ESS is that it can serve the whole range of line sizes from the very smallest community up to a large metropolitan city. The one at Seneca will provide service to 1,250 customers.

"The range of services that a No. 5 can provide is phenomenal," said Fred Wallitsch, General Manager of Northern Illinois Works, where the Seneca switch was assembled. "The system will eventually be able to serve any size office from small remote ones in rural areas to large urban local or local/toll (long distance) offices with thousands of lines and trunks.

"The No. 5 ESS," he continued, "will bring to rural areas, now served primarily by older electromechanical switching systems, all of the Custom Calling Services available to customers served by our current big runner, the No. 1A ESS. Optional features include Call Waiting, Call Forwarding, Three-Way Calling, Speed Calling, etc. In addition, there is the potential for providing a wide variety of new services."

The growability of the No. 5 ESS is possible because the hardware and software have both been designed as modular units that can be put together like building blocks. The large range of lines gives the system a lot of flexibility and is a great advantage to the customer.

The system will include remote switching capability to allow even the smallest installation to provide the benefits of modern stored program control and the latest in electronic features to its customers.

According to Jack Warner, there are three things that differentiate the No. 5 from the other electronic switching systems we make:

1. "Its network is digital, providing time-division switching of local calls, and it can work directly with digital transmission systems, such as T carrier and, in the near future, the digital SLC* 96 subscriber loop carrier system. The digital local switch eliminates the need for some traditional equipment such as analog to digital channel banks.

2. "The hardware design is modular, with well defined interfaces between the units and modules. We expect to be able to quickly take advantage of new technological advances by modernizing individual units without changing the interface requirements. We also should be able to expand capacity very economically. This particular version is our first, a single-module system for

*Trademark of Western Electric.

small towns. Next year, we expect to have a multi-module version for suburban and small-city use. By 1983, we expect to have several more variations including local/toll and remote switching modules, that will work from a host No. 5 ESS serving a wide area.

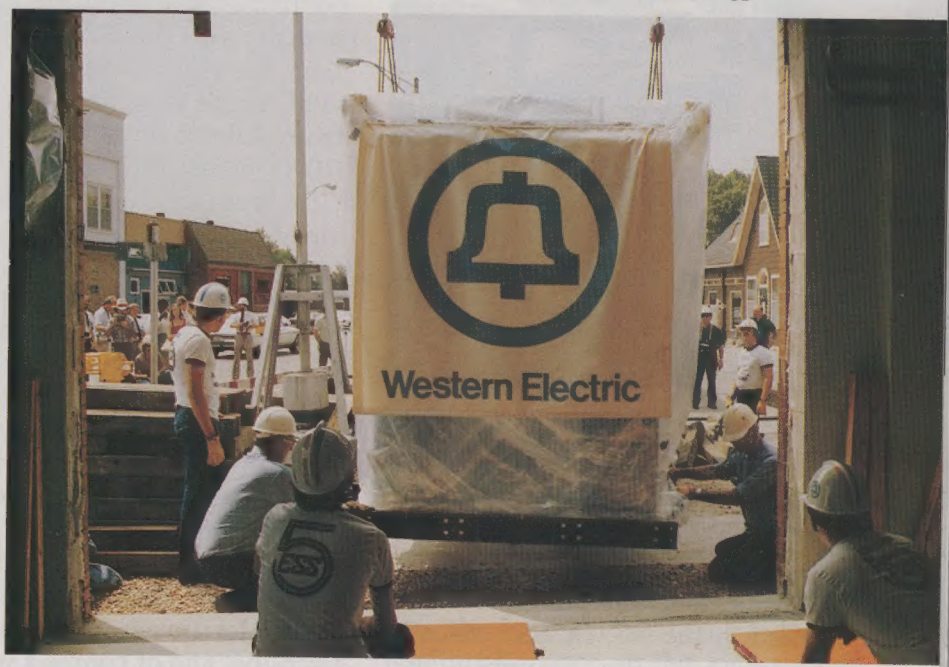
3. "No. 5 ESS uses modular software design as well as modular hardware. I believe software modularity will decrease program complexity when adding new service features as the technology advances."

The No. 5 system is being designed to be compatible with the entire family of Western Electric systems for maintenance, administration and traffic support. These would include such computerized programs as EADAS (Engineering and Administrative Data Acquisition System), AMARC (Automatic Message Accounting Recording Center) and SCCS (Switching Control Center System). Data links would provide the interconnection between the central office and the telephone company's teleprocessing center.

On the day the unitized package arrived in Seneca, the main job of the WE installation crew was to dismantle the unitizing frame and make sure that all equipment frames were correctly positioned on the previously laid-out markings and drilled holes on the floor.

Four WE installers (Nick Boettcher, Jim Campbell, Phil Dreher, and Mike Tanner) along with Job Supervisor Gerry Carr attended a special four-week training course at Northern Illinois Works to prepare them for work on the new system. "It's a relatively small crew," said Orbit Supervisor Charley Breier, who works out of Lombard, "and they'll be spread over two or three shifts."

Left — The 22 ft. by 6 ft. by 8½ ft. switch is lowered to ground level at the Illinois Bell office while the whole town watches.
Below — The 13,600-pound "package" inches by the town's flagpole.



The range of services that a No.5 ESS can provide is phenomenal. So is the range of office sizes it can handle

No. 5 ESS uses all the latest technologies, including VLSI and fiber optic cables

Before the No. 5 crew arrived, another WE installer Mark Whisnant had been on site preparing the power supply.

Seneca is 12 miles from Morris, Illinois, site of the first electronic switching trial in 1960. None of the installers had been involved with

Gated diodes are vital to the operation of the No. 5 ESS. Here Tom Hankus tests Seneca's GDX boards.

that milestone job, but most had worked in the No. 1A ESS office in Morris. Only Jim Campbell had worked in Seneca before—in 1965, in one of the many modifications that had been put in over the years on the step-by-step equipment. He remembers it because "it was the first time I had to work midnights."

Since Seneca is a new system, like other new equipment, Bell Labs has a site team located in an office nearby to monitor what is happening in the telephone office during the on-site testing phase and to check other software ideas for future models. Barry Posterick and Jim Dumas from Indian Hill and Larry Budnick, on loan from Western's Northeastern Region, were working feverishly to have everything ready to start their tests as soon as the new office was powered up.

The No. 5 ESS local digital switch was designed primarily by people at Bell Labs' Indian Hill facility in Naperville, Ill., and the equipment was assembled and system tested at Western's Northern Illinois Works in Lisle. Vital contributions to the project, however, came from all over the country.

"In addition to what we made at Northern Illinois Works there were 15 other Western Electric plants that contributed equipment and components for the Seneca job," said Jack Garrett. "And they were all vital. There were integrated circuits from Allentown and Kansas City. GDX (gated diode crosspoint) devices from Reading. Hawthorne provided ceramic substrates—film integrated circuits—and capacitors. Connectors came from Dallas and Oklahoma City; lightguide from Atlanta; wire and cable from Omaha; printed wiring boards from Richmond and Montgomery; power converters from Kearny; fuses and Bellpac* packaging system hardware from Columbus; gas tube protectors from Baltimore and other small electronic components from Merrimack Valley and North Carolina, and of course a whole host of purchased items where the efforts of many of our purchasing division people were essential. I hope I didn't leave anybody out."

According to Garrett, "The manufacture of digital switching equipment is not significantly more complicated than other electronic switching systems. There are three distinct types of circuit packs: analog, digital and gated diode crosspoint." They are all modular and contain a great deal more circuitry than some of the specialized boards used in earlier ESS models. "We make very extensive use of VLSI, that is, very large scale integration," he continued. "The Seneca system is, of course, smaller than the 1As we've been making. This office can serve up to 2,000 lines where the 1A is in the tens of thousands. But the key difference, I believe, is in the testing. I don't know how to give you any measure of the difference except in terms of capital investment. Upwards of 60 percent of that investment for No. 5 ESS goes for testing. We run extensive system tests in addition to all of the production testing that is done on the component parts. And the system does a lot of checking on itself." The No. 5 ESS is small and compact. A variety of floor plans and options and packages will be available once production gets rolling. The unit for Seneca was roughly 22 feet long by 6 feet wide and 8½ feet high. Though standardized, the No. 5 floor plans have a great deal of built-in flexibility.

The 3B processor is the "brains" or central processor of No. 5 ESS. Technicians communicate with it through a modern cathode-ray-tube terminal.

The No. 5 ESS has part of the master control function handled by microprocessors mounted in the switching frames. This means that when more capacity is needed, and additional switching frames are added, additional processor capacity is added at the same time. This reduces the start-up cost for small offices, so that the telephone company doesn't get hit with the whole processor cost at the outset.

No. 5 ESS makes extensive use of the latest technology in integrated circuits and Bellpac systems in both the 3B processor and switching

*Trademark of Western Electric.

At Northern Illinois Works, portions of a "live" No. 5 office are used for hands-on training. Here RTAC engineers, who will be responsible for field service, puzzle over a maintenance problem.

frames. The result is a very compact system. This permits the offices to be assembled, interconnected and system tested at the factory.

"We frankly prefer shipping the No. 5 as a unit rather than as separate frames," Garrett said. "It's much more efficient. The unit we have going in today here in Seneca was functioning in the factory yesterday. We can have it all powered up here in another 24 hours. Since this is a first we will be doing a lot of additional on-site testing. Our cutover date is many months away. But in the future I would expect we would be able to reduce the on-site test interval significantly."

We spoke at some length with Jim Schouweiler, manager in the ESS PECC Center, about the time it has taken to get the local digital switch in service. "If you measure from the time Bell Labs undertook development," he said, "it would be about four years. I should point out, however, that Seneca will be the first *commercial* use. We have made a number of prototype models that have been in experimental use for a while at various labs at Indian Hill. And there are well over 50 of the 3B processors in the Bell System at various locations all around the country."

According to Schouweiler, two of the most interesting innovations in the No. 5 ESS from an engineering and manufacturing point of view are the use of lightguide for interconnection between equipment bays and the use of gated diodes as switches.

The use of lightguide is a first in a switching application. The lightguide cables greatly reduce the number of metallic cables required on the backplanes of No. 5 ESS Bellpac systems. More importantly, perhaps, lightguide signals are immune to electromagnetic interference, so that noise, crosstalk and other such problems are avoided.

The gated diode is a state-of-the-art solid-state device made at Reading. It is an integrated circuit capable of handling high-voltage signals used for power, signaling, ringing and testing in the subscriber loop. It can withstand voltage surges of up to 500 volts.

Northern Illinois Works will continue to manufacture No. 5 ESS systems. In 1982, Oklahoma City Works is scheduled to begin manufacturing operations (they are already turning out the 3B processor) and will gradually take over as the high-volume manufacturer.

"By 1984," Garrett concluded, "I wouldn't be surprised if we were turning out as many No. 5 systems as we are now turning out 1A systems.

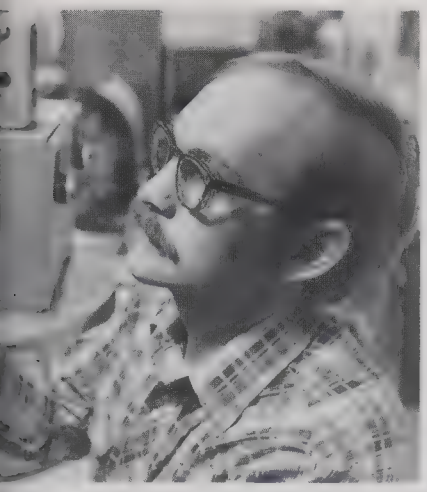
"There's clearly movement toward all-digital broadband transmission," he added, "and in the long run, all-digital is the network's future." WE

Usually, kids are fascinated by the clowns, or the animals or the trapeze artists. For Joe Dougherty, it was the wagons

Like a modern-day P.T. Barnum, Joseph Dougherty stands on wall overlooking his impressive collection of colorful circus wagons.

"For the circus is a magnet drawing its people from far-flung lands . . . and their languages are as varied as the tongues of Babel. To some it is a home . . . to others it is fame and excitement . . . to many it is fortune."

Cecil B. DeMille



Joe earns the money to pay for his unusual hobby as a layout operator at Allentown.

CIRCUS

By Adele Donohue-Evans
Photos by Joseph Gazdak

If the circus is a magnet, as Cecil B. DeMille described it, perhaps that explains the way it attracts Joseph Dougherty. A layout operator at the Allentown Works, Joe is one of those "boys aged seven to seventy" who has been under the magic spell of the circus for about as long as he can remember.

"When I was five or six years old, I first remember seeing Ringling Brothers Circus. We lived two blocks from the Allentown fairgrounds and one week a year, the circus would come to town. Everybody in the neighborhood would get up at 5 A.M. to see the elephants go by," Joe recalled.

For most children, including Joe Dougherty, the circus was a fabulous world of make-believe; for a few hours it took them into another world — of high-stepping horses, bespangled trapeze artists and laughing clowns. After the performances were over and the popcorn boxes empty, the other children forgot all about it — until the next time the circus came to town. But not Joe Dougherty.

"I wasn't like the other kids who forgot about the circus when the tents were taken down and it left town. I was always left with questions in my mind," Joe explained. His questions, however, were not about the clowns and the acrobats. Joe was more concerned with the mechanical aspects of the circus, especially the wagons.

"Instead of being in the big top watching the acts, I was crawling under circus wagons learning how they were made," Joe said.

And all that time spent underneath circus wagons seems to have paid off. Joe has been building and restoring circus wagons for about 15 years. He has built two three-quarter sized wagons (6 ft. wide, 14 ft. long, 8 ft. high), an equipment wagon and a concession wagon, of the type used by Ringling Brothers and Barnum and Bailey Circus in the 1940s and '50s. He also owns two authentic circus wagons which he plans to restore to their former glory. He has exhibited his wagons in local parades and at model conventions.

Joe learned his craft not only from crawling under wagons, but also by being an avid reader of circus history books and a careful listener at the countless circuses and carnivals he has attended. Through his many conversations with circus folk, Joe has learned a great deal about the construction of the steel and wooden wagons.

When he plans to build a wagon, Joe first draws it on paper to scale and then determines how much steel he'll need. At a considerable savings (a fully equipped concession wagon could sell today for as much as $30,000), Joe does all the work himself, from designing and building the wagon's steel undergear to the final paint job on its wooden exterior. Joe figures that he has put about $5,000 into the building of his concession wagon over the past two years. And that includes a commercial microwave oven and all the other necessary kitchen equipment.

In addition to weekends, Joe spends about two to three hours a day working on various circus-related projects. Joe prefers working the second shift at the Works because it gives him a few hours in the mornings and early afternoons to devote to his time-consuming hobby. Most of the work is done in a friend and fellow circus buff's garage which is equipped with the machinery needed to build the wagons.

Joe is a member of Circus Model Buildings, an international organization that holds a national convention each year and publishes a bimonthly magazine for circus model buffs. Each year, he attends the club's convention as well as several other large carnivals in places such as Maryland, Wisconsin, Minnesota and Canada.

State fairs are held in late summer or early fall. Last summer, Joe spent part of his vacation visiting a friend at the New York State Fair in Syracuse, N.Y. He had hoped to work at a fair in his concession wagon, but couldn't complete his wagon in time. However, by next summer, he hopes his fire-engine red concession wagon will be fully equipped to sell lemonade and hot submarine sandwiches to thirsty and hungry carnival goers. Joe believes summer stints as a concession-stand operator will prepare him for his ultimate goal, which is to go on the road after retirement. He has been with the company for 22 years.

"I don't want to spend my life just wishing I had done something I've always wanted to do, so I'm working toward that goal now," he explained.

Eventually Joe thinks he would like to travel with a carnival for about three to five months a year. He would run the stand part time and perhaps do behind-the-scenes shop work the rest of the time. He certainly has the necessary experience for the job.

Many people have a dream about something they'd like to do, somewhere they'd like to go, or someone they'd like to be — *someday*. But not too many of them ever live to see those dreams realized.

But once again, Joe Dougherty is different. Maybe it's the way he talks about the special carnival smells, of freshly cut grass just before the tents go up, or the mixed aroma of sawdust, popcorn and cotton candy in the big top, that makes you believe that he'll live out his dream one day. Someday, in the not-too-distant future, Joe will be on the road, part of that world of dancing elephants, high-wire walkers and brightly painted wagons. WE

On October 21, 1931, Leo Lowenstein, proprietor of the Nassau Smelting and Refining Works, the Tottenville Copper Company, and the Argus Smelting Company of Staten Island, New York told his employees these properties had been acquired by Western Electric. His speech, which can be found in Western's archives, is memorable because of its forward-looking perspective on recycling and conservation of resources.

"Through the operations conducted at Tottenville," Lowenstein told his employees, "it will be possible for the telephone interests to effect economies in the reclamation and conservation of secondary-metal by-products —which they accumulate in greater tonnages than any other industry in the world—to the point that these economies may reflect themselves in the cost of telephone equipment and installation . . . affording them an added opportunity to reflect those economies in telephone service."

A Golden Year for Nassau

By Elizabeth M. Perlman Photos by Chuck Lewis

For half a century, Nassau Recycle has been putting copper, gold, platinum, aluminum, lead and other materials back into circulation

Above—Harold Wagle, Nassau's president, leads the subsidiary into its second 50 years. Left—Anodes are cast at the rate of 65 tons per hour.

So began the relationship 50 years ago between Western and the subsidiary that has since been renamed Nassau Recycle Corporation. In addition to its name, many other things have changed over the years, including the location of Nassau's headquarters and the volume of business. But the commitment to reclaim Bell System scrap is still its way of life.

Harold Wagle, current president of Nassau Recycle, has high praise for the WE executives who had the foresight to acquire a recycling operation in the 30s. "We were recycling at Hawthorne, later at Kearny, and then at Nassau prior to the 'recycle' movement. These individuals had great vision back then, because recycling has proven to be the way of the future. It's only recently that recycling has become the 'in thing': to conserve our natural resources. However, it's been an 'in thing' with the Bell System for a long time."

The acquisition and growth of Nassau Recycle has mirrored to a large extent the growth of Western Electric. The original Nassau facility in Staten Island is situated on a 40-acre tract. In the 30s, it was large by contemporary standards and produced more copper than any company of its kind in the world. In the 40s, 50s, and 60s, improved methods of manufacturing, design of new equipment, changes in tools and machin-

Left — A tap hole is opened on the furnace in preparation for casting copper. Above — Tons of copper are reclaimed and then sold to Western Electric each year. Right — Lead pigs are just one of the many products that leave Nassau Recycle.

ery, and the tremendous growth of the telephone network all added to the volume of scrap it received. By the early 70s, over two thirds of Nassau's scrap had to be sub-contracted and a search was made for a new and bigger location.

Wagle explains, "In the early 70s, it became obvious that we had to have more space and a more modern facility to recycle Bell System scrap. During one of the least profitable years in Western's history we committed a great deal of money to this facility in Gaston. The decision was made in 1975.

"In 1978, we moved in. We're located centrally between the major cable plants at Atlanta and Baltimore to which we ship most of our reclaimed copper. We have 414 acres here. The equipment is modern—our operations have been so successful that we get requests from people all over the world who want to tour the facility."

Nassau's agents purchase central office equipment, outside plant equipment, and business or residential scrap in any quantity and at any geographical location. As much as 250 million pounds of copper rod per year are recovered from these materials. The Gaston facility is one of the largest copper-reclamation operations in the world. The copper-bearing scrap is converted into copper rod that must meet Bell System standards of 99.98% purity through several processes that may include refining in a blast furnace, in reverberatory furnaces, electrolytic refining processes, or fire refining processes.

Each day at Gaston, boxcars and truck trailers from all over the United States roll up to the receiving bays to unload scrap. The scrap is sorted, weighed and assigned an appropriate classification to await processing.

The next step in the process is called "mechanical upgrading." The scrap is physically separated into copper-bearing and non-copper-bearing components. Low-grade material is processed through shredding and sorting machines, which shear it into pieces, liberating the iron, aluminum, and non-metallic materials from the valuable copper and precious metals.

Lightweight combustible material is removed by a vacuum process. Ferrous materials are removed by magnetic separators. Finally, the aluminum is taken to a metal recovery plant, where it is removed. The remaining material—containing telephone bells, contact points, zinc die castings, and miscellaneous brasses and bronzes —is fed to the converter furnace. Through this process, saleable by-products, as well as a refinable copper fraction, are retrieved.

After the scrap has been mechanically upgraded, the next phase is the metallurgical refining process. There are two routes the copper can take before it is processed into rod: fire refining or electrolytic refining. In the fire refining process, very high grade scrap is refined to sufficient purity for high-conductivity rod production. It is then directly cast and rolled into rod.

Electrolytic refining of copper begins in a tilting rever-

beratory furnace. Copper from the furnace is cast into 780 pound anode plates and transported to Nassau's tankhouse. This huge building has rows and rows of cells in vats in which plates of copper are suspended.

Copper starter sheets are produced over a 24-hour period during which copper plates onto a sheet of titanium. The thin copper sheets, which are manually stripped from the titanium plates, are moved to other electrolytic cells, where additional copper will be plated for 14 days to form a cathode. The cathode is then melted to prepare it for producing copper rod.

Liquid copper of more than 2000 degrees Fahrenheit is cast at a rate of 45 tons per hour to form a rectangular bar. The bar moves into a 15-stand rolling mill to be reduced to a 5/16 inch diameter rod. The rod, whizzing out of the mill at about 60 miles per hour, moves into a cooling section, which drops its temperature 1000 degrees in one second. It is then cleaned and prepared for coiling. The final product is a coil of copper rod that weighs about 8000 pounds.

The copper coils are then shipped to Western Electric's cable plants where they are drawn into communication wire—a full circle from use to recycle to reuse.

In addition to the copper, the other by-products—gold, silver, platinum, lead, aluminum, plastics, and palladium —that Nassau recycles, reclaims, and resells, contribute a good deal to its inventory. The facility in Staten Island processes over 200,000 troy ounces of gold annually. The price of this metal must be monitored hourly. The prices of gold on the New York and London exchanges are a visible part of the office decor—flashing in green on a video display terminal—in Wagle's office in Gaston.

Everyone agrees that it is less expensive—in the short run as well as in the long run—to recycle, to reclaim our natural resources rather than to squander them. In a recent interview in *Electronic Engineering Times*, Don Procknow, President of Western Electric, spoke about Nassau Recycle and its role in the Company. He said, "We have been in the reclamation business a long time. It costs a lot less energy to reclaim copper from cable and other telecommunication products than it does to start from scratch to get copper from copper ore."

For 50 years, Nassau Recycle has been Western's conservation specialist. There are challenges today—new materials, a shift in markets for precious metals, oil-based materials such as plastic that can be recycled inexpensively—that will take Nassau into its next 50 years. New techniques, improved methods, inventive processes —that's how Nassau extracts every worthwhile bit out of Bell System scrap. WE

Every winter, Ralph Higgins undergoes a marvelous transformation into the Nutcracker's mysterious Herr Drosselmeyer

All the World's A Stage

Photos by Detlev W. Kempe

Above — Ralph puts on the face of Herr Drosselmeyer for the ballet.

Ralph Higgins, an engineering associate in the Precious Metals Recovery and Conservation department at the Engineering Research Center in Hopewell, New Jersey, calls himself a "jack of all trades." Before he joined Western Electric 20 years ago, he taught English, drama, and speech; he acted in summer stock and off-Broadway shows; he spent three years in the Air Force; he was a door-to-door salesman; and he crowded in a stint as a metallurgical inspector. Of all his trades, Ralph speaks most enthusiastically about his years in the theater. Acting is in his blood, but he didn't pursue a full-time acting career. Instead, he takes center stage briefly each winter in the Princeton Ballet Company's production of *The Nutcracker.*

For the past 13 years, Ralph has performed the part of Herr Drosselmeyer, the mysterious but benevolent old man whose Christmas present of a nutcracker to a young girl sets the ballet in motion. The chain of events that results from the gift leads to the fairytale dream portion of the ballet in which the nutcracker comes to life, is transformed into a prince, and acts as the young girl's guide in the palace of the sugar-plum fairy.

"I'm not a dancer," Ralph asserts. "From my acting background, especially from doing Shakespeare, I developed a style of exaggerated gestures, not really dance, but pantomime." Herr Drosselmeyer, with his eye patch and black cape, should appear mischievous and enchanting. Ralph explains, "He has magical powers and should appear spooky until he starts to grow on the audience. He commands the attention of the children with his mechanical toys and dominates the stage during the first act until the nutcracker is transformed into the prince in the young girl's dream."

Ralph admits that he had never seen a ballet before his two daughters took ballet lessons. "As part of their annual recitals," he explains, "the children performed parts of the classical ballets with the ballet school. They needed parents to play the older parts and about 15 years ago my wife volunteered me because of my stage experience. From these recitals, I moved into the ballet company's production of *The Nutcracker,* and I've been at it ever since.

"The ballet company has a fine reputation and it's very professional. Last year, we appeared on NBC's *Today* show."

After all these years, Ralph knows his part in the ballet very well. "They start rehearsing in September, but they don't call me in until November. Each year, the children grow a little and it's such a wonder to see the little ones—they start dancing the roles of the baby mice and, well, I've seen some of them take on the lead roles. I thought I quit the theater all those years ago because I might be getting too old, but you never know what will come up—I started in ballet when I was almost 50." WE

Above right — At the ERC, Ralph's "stage" is a laboratory. Far right — Herr Drosselmeyer presents the grotesque mask of the nutcracker to the spellbound audience.

Bob Woods routinely makes a big thing out of little things with the help of a very special precision instrument.

Woods, who is a microscopist at the Engineering Research Center in Princeton, N.J., works with a scanning electron microscope, or SEM for short.

This high technology instrument relates to the optical microscope in the same way the space shuttle relates to the Wright brothers' first plane: it does the same kind of thing, but in a radically different way and with radically different results.

Where the optical microscope uses lightwaves to "project" an enlarged view of a specimen to the eye, the SEM uses a beam of electrons to draw an enlarged picture of the specimen on the face of a cathode ray tube—in very much the same way electron beams draw the pictures on your TV set. The big advantage is that photos taken with an electron microscope can show magnifications over 100 times as large as those taken with an optical microscope.

According to Woods, the reason is that optical microscopes can't "see" anything smaller than the wavelength of the light illuminating the specimen being viewed, which is about one millionth of a meter. The wavelength of an electron beam is thousands of times shorter, so an electron microscope can "see" objects hundreds of times smaller.

Woods' World

Vital to much of the research at the ERC, Bob Woods' SEM photos have an esthetic side, too

An SEM offers another big advantage—as is demonstrated on the next two pages. Its pictures have an extraordinary, lifelike quality. In fact, they appear almost three dimensional. This vivid effect is due to the SEM's tremendous depth of focus. Everything within the instrument's field of view, both hill and dale, is usually in sharp focus. On the other hand, if you're looking at one feature on a specimen's surface through an optical microscope, everything higher or lower will be out of focus. Consequently, most optical microphotographs appear perfectly flat.

Woods' SEM can magnify objects up to 100,000 times their actual size. He says another type of electron microscope, known as the TEM (for transmission electron microscope) can magnify up to one million diameters, but its pictures are as flat as an optical microscope's, and it can't be used to directly view surfaces of opaque specimens.

"And surfaces," says Woods, "are usually where the action is. For example, the Chemical Technology Group is constantly treating the surfaces of different materials in different ways and then examining them to see if they can relate topographical features to good adhesion of copper to printed wiring boards. Then, they bring samples to me for SEM pictures—hundreds of them."

An engineering associate, Woods came to the Engineering Research Center 21 years ago—one month after leaving the Army. He learned electron microscopy in 1967, taught by a boss who left the company nine months later. Woods inherited the job and has loved it ever since. It doesn't take long to see why.

Bob Woods at the controls of his scanning electron microscope. The "tower" at the left is the vacuum chamber into which all specimens are placed for viewing.

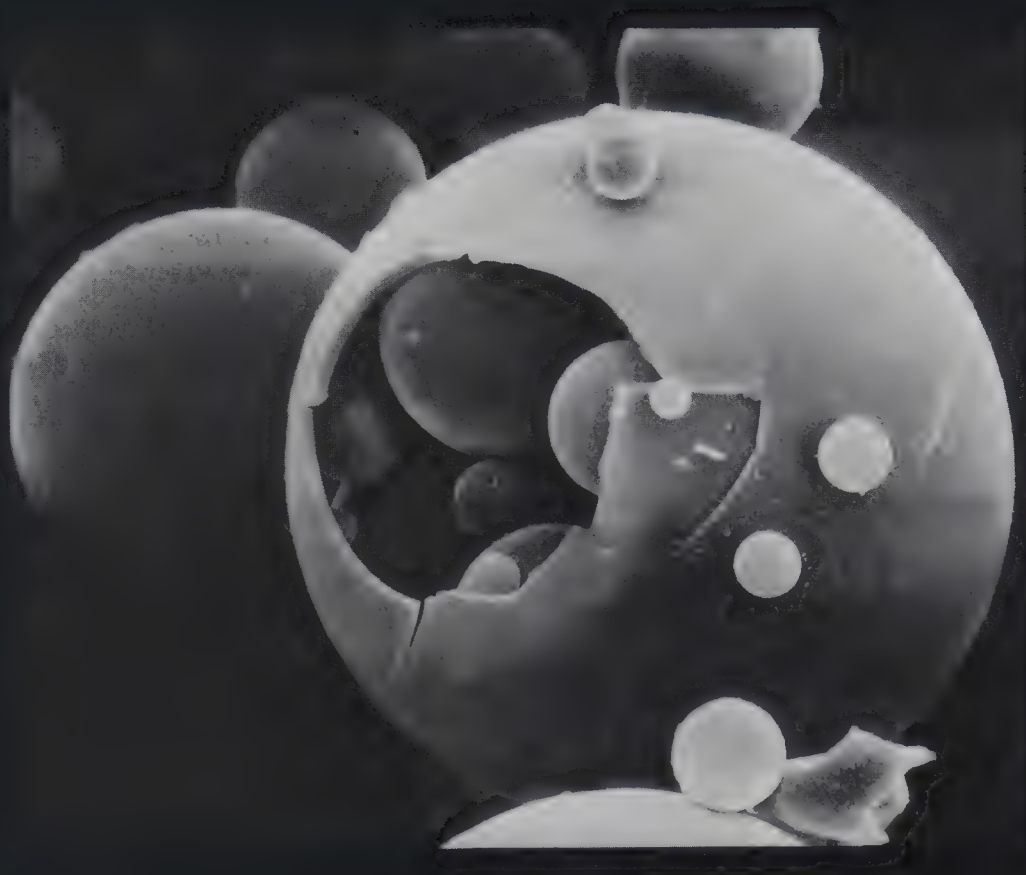
Operating the controls of his fabulous machine is a little like flying in a strange and fabulous world: a little twist of this control, and you zoom down into a dark crater; a little twist of that control, and you're soaring over the crest of a high mountain. And it's always different.

"The job is always interesting," says Woods, "because I get involved in such a wide variety of projects. I've done work for every research group here at the Center that deals with materials—and that means every group except for the computer people. I see everybody's problems, and I like to think I'm helping people solve them."

Woods helps solve researchers' problems not only with his remarkable pictures, but with other vital information as well. One valuable side benefit of the SEM is that specimens emit x-rays when they are bombarded by the instrument's high-energy electron beam. The energy of those x-rays differs from one element to another—a characteristic that can be used to identify them with the help of computer-controlled equipment. Thus, Woods can provide researchers with photos of contaminants and other troublesome agents and also tell them what they are.

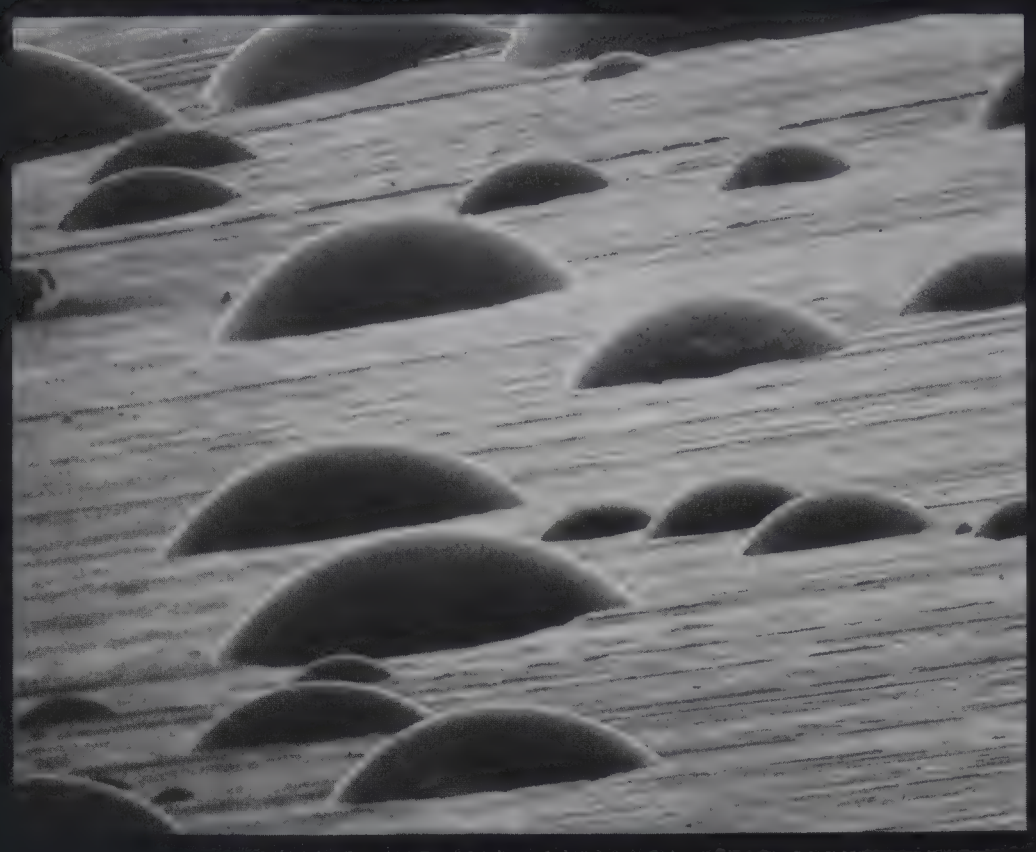
Even after all these years, Woods is not immune to the asthetic side of his job. "There's a lot of beauty in the way nature structures herself on the surface of things, he says. "You see things that relate to the world around you, things like roses, cabbages, playful seals and birds' wings."

To enter the wee world of Bob Woods, turn the page.

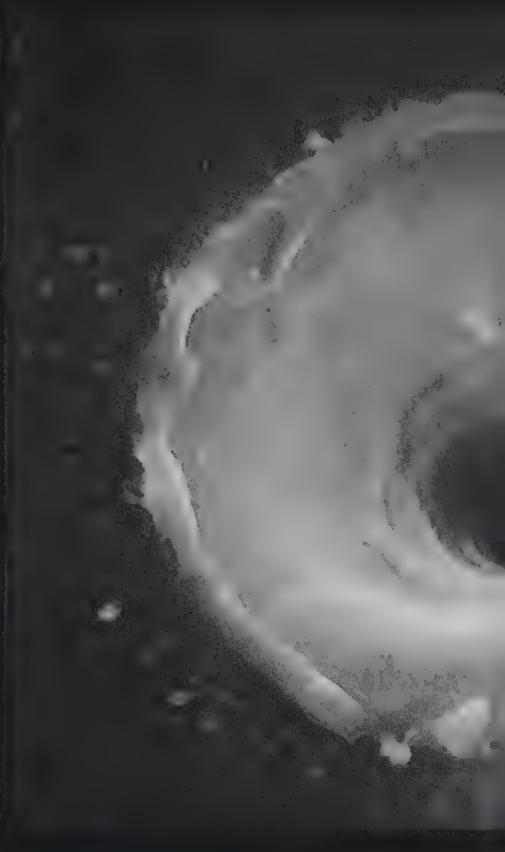


Glass beads (magnified 900 times)

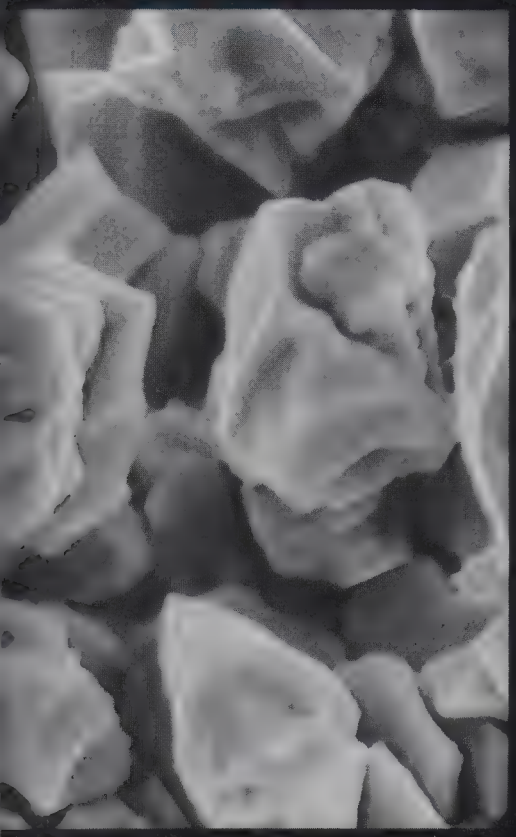
Electro-deposited gold



Epoxy powder on aluminum substrate (magnified 500 times)

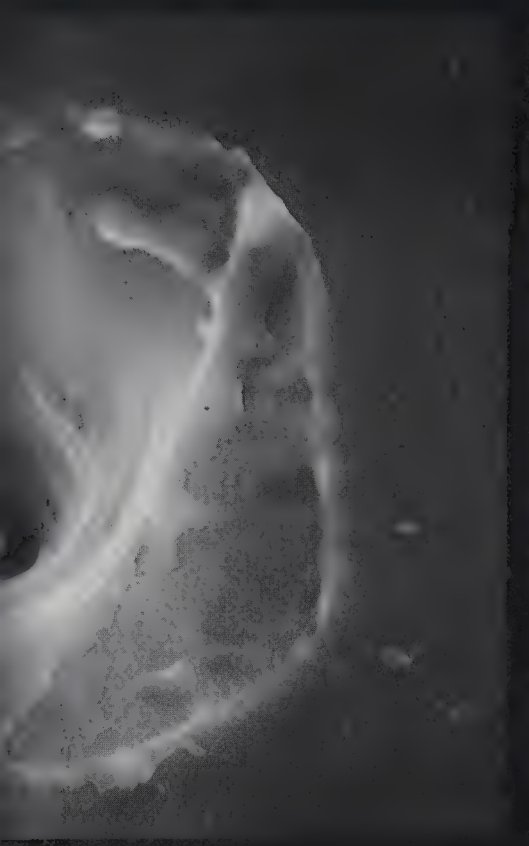


Laser-drilled hole in silicon wafer

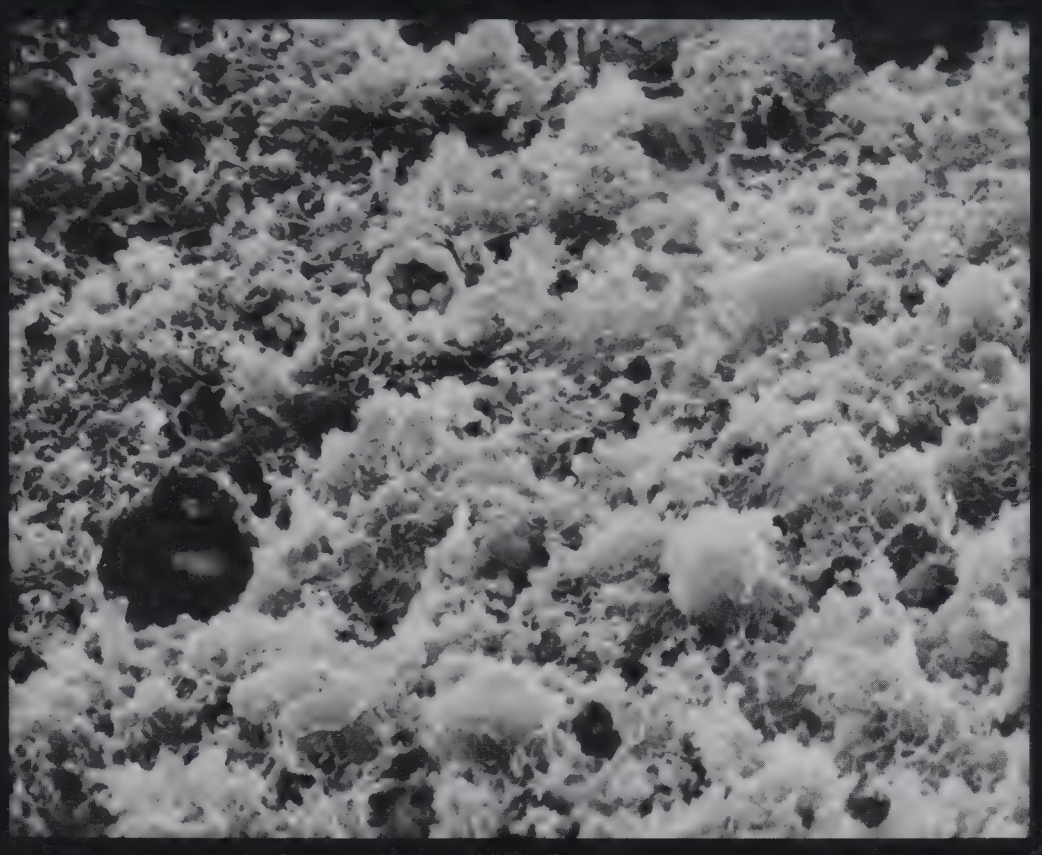


(magnified 5,000 times)

Ball of solder (magnified 35 times)



(magnified 2,400 times)



Etched epoxy on hardboard (magnified 2,100 times)

ISSMs

By Saul Fingerman
Photos by
Richard Faverty
and Len Stern

Software is what brings electronic switching to life. Here are some of the people who bring the software to life

Left — Lyn Weaver and Kathy Huml check over one thing they read a lot of — computer printouts. Right — A roomful of ISSMs. Joyce Malleck presides over a meeting being held to discuss progress and problems.

Lyn Weaver and Kathy Huml are ISSMs. Like many ISSMs, they're young and bright and as much at home with computer terminals as most people are with television sets. In addition to being ISSMs and working at the Switching Software Center in Lisle, Ill., they have a lot of other things in common. They've both done a lot of programming, they've both been with WE for a little over four years, they're both involved with the same project at the Center and they're both members of that esoteric new breed of people who put the brains into what is often called artificial intelligence. In their case, it's the artificial intelligence that makes No. 4 electronic switching systems so smart.

Their end product is called an Office Data Assembler, or ODA. This is a set of computer programs which creates an incredibly complex maze of data tables that provides the No. 4 ESS master control program with all the information it needs to make the millions of decisions it must to complete long-distance calls.

ISSM, by the way, is alphabet soup for Information Systems Staff Member. To an outsider, alphabet soup seems to be the very essence of their work—not only in the cryptic languages of their programs, but even in the routine vocabulary of their day-to-day conversation. Sitting in on one of their frequent meet-

ings can make you feel like you've been beamed up to an alien world. It's a numbing experience, something like listening to conversation consisting of English fragments smothered in a thick soup of numbers, acronyms and exotic verbs.

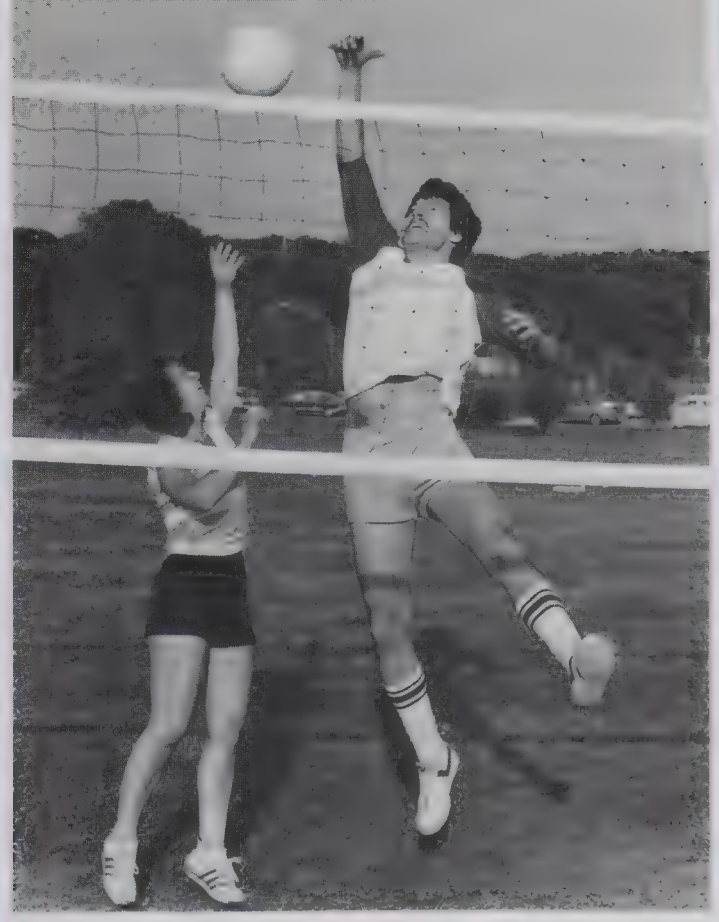
Asked about this strange state of affairs, their boss, Department Chief Joyce Malleck, admitted that jargon was second nature to software people in general and to the ODA group in particular. "We can talk to each other," she says, "but nobody else knows what we're talking about." You can detect a hint of understandable pride of membership in an elite group.

KATHY HUML

The ODA group consists of 60 engineering, testing and development people, whose contributions to the project must be carefully synchronized and coordinated. Handling this is Kathy Huml, who has had the project engineering control function for about a year.

"Our job is to coordinate changes in new releases of ODAs," says Kathy, "and there are a lot of them. To do it, we have to monitor everything connected with the ODAs. We investigate trouble reports, make up schedules and work assignments and coordinate new feature designs from Bell Labs."

She finds scheduling the hardest thing to control, because there are so many people doing so many dif-



started as a math major before switching to elementary education and psychology. What's more, on the advice of one of her teachers, she had taken a few introductory computer courses during summer vacations and really enjoyed them. At one of these courses, she met a WE technician who was studying to be a programmer. At his suggestion, she applied for a job at the Software Center, passed a programming aptitude test and was hired.

She started in something called Job Data Pre-processor Merge, or JDP, for short. It was essentially "number crunching" of vast amounts of data. Because it is the

The test group's common purpose and philosophy is to find every way a No.4 ESS user can break the software

Above — Kathy and husband Dan enjoy a volleyball game. Right — Conference time again. Lyn meets with fellow ISSMs (clockwise) Ronna Rykowski, Tom Harrington, Steve Alesch, Mike Sayen and Brad Baznik.

ferent things. If one is out sick for a couple of days, that can throw everything off and send Kathy back to the drawing board to change dozens of schedules. *Change* is the key word here. "Both Kathy and Lyn work with change on an epic scale," says Joyce. "It's partly because we're in a relatively new field and partly because the technology moves so fast. That's why continuous education is so important in this business."

Nobody knows this better than Kathy, who has taken several CEC courses and is currently studying for her masters degree in computer science at Northern Illinois University. "I'll probably be taking courses for the rest of my software career," she says.

It is a career that she came to somewhat indirectly. A former grade school teacher in West Illinois, Kathy felt she wasn't using the math she learned at Naperville's North Central College. She had, in fact,

Center's policy to broaden people by moving them around a lot, Kathy worked on several projects before her present assignment, including one called TRAMP, for Translator-Mapping Program.

Her most difficult task was to make a lot of changes to a program that had been written "spaghetti style"—meaning it wasn't carefully structured or modular the way ODAs are now. Unstructured programs are hard to "read," so it was a little like trying to edit a book written in a foreign language. And the lack of modularity—that is, the division of a program into bite-size chunks—made it equivalent to a book without chapters or even paragraphs. Since then, structuring has become the dominant mode at the Center—not only for programs, but for the organizations producing them, as well. This means that project groups are now assigned clearly defined responsibilities. They have, like the programs themselves, become more modular. In the past, for example, programmers were responsible for testing their own programs. Now, their creations undergo formalized testing by a completely objective test team.

She is emphatic in her belief that modern programming is very much a team effort. "With something like No. 4 ESS, it's much too complex to be anything else. The individual effort may work for things like payroll programs, but not for the No. 4 ODA, which has so many subsystems that must work together. We're very team-oriented here, and we really get along. A lot of us were new together, and we grew together."

She enjoys her present job most of the time. "I like the responsibility and interfacing with all the other people. But, acting as coordinator, I get to hear everybody's complaints, and, sometimes, that's not the greatest." Her only other reservation about the job is her fear of losing her fluency in the three computer languages she knows, because the coordinator's job doesn't call for any programming. "It's just like any other language," she says, "if you don't use it, you get rusty."

As far as she's concerned, the most fascinating thing about computers is their speed—the fact that they can do millions of operations a second. What's more she has a "pretty good" understanding of how they do it—thanks to studying basic computer circuits in some of her courses.

She believes anybody can learn to be a programmer, but it takes talent to become a good one. "Some people can look at a programming problem and solve it in minutes. Others will take days, or just not be able to do it at all." She also feels a programmer must be systematic, logical and enjoy a challenge. It also helps to be a "divergent thinker"—able to look at a problem from many points of view. Her advice to would-be programmers is to get as thorough a math and software background as possible through books and courses.

Looking ahead, Kathy says she is still undecided about her career aspirations, but is leaning more and more toward supervision than the technical side of things. "For the time being," she says, "I'm trying to improve my technical capabilities to make me more capable of handling a supervisory role."

Off the job, she relaxes with crossword puzzles, tennis and strenuous games of volleyball with her husband, Dan, a technician at the Northern Illinois Works, where he tests circuit packs. Although they have no personal computer at home, she says Dan is planning to build one soon. She isn't sure just what they'll do with it when he does.

LYN WEAVER

Where Kathy came to software by a somewhat circuitous route, Lyn Weaver made straight for it right from her undergraduate days at the University of Illinois, from which she graduated with a B.S. in math and computer science. Earlier, she had started another college as a math and music major, but one of her advisors persuaded her to take a couple of programming courses. It was love at first sight, and that was that. After graduation, she went right into software work as a technical analyst for a Milwaukee firm and in 1977 found her way to WE's Switching Software Center.

Lyn ("Nobody ever calls me Carolyn") belongs to a software family. Her husband, Dave, whom she met in a computer science class at college, is a software consultant for a small engineering firm. Her brother is a software man at Bell Labs' Indian Hill facility, and even her doctor father recently requested an introductory computer book for Father's Day.

She is fluent in five computer languages, her favorite being something called PL-1, because "It is structured the way I think." However, like Kathy, she does no programming in her present job, which is project leader of the systems test group.

The group consists of 12 people

with a common purpose and philosophy, which is to find every way a No. 4 ESS user can "break" the software. "Programmers try to prove their programs work," says Lyn. "We try to prove they don't. We're the bad guys in the group. We're always looking for everybody else's mistakes. Sometimes, this makes for a ticklish situation, but it's the nature of the job."

Testing a new ODA release takes about seven weeks, depending on the number of changes it has. "You have to completely understand the ODA, because part of testing is 'eyeballing' printouts of the programs, and they're enormous." She holds her hands about 16 inches apart to indicate a stack of printouts. "For other tests," she continues, "we treat the programs as 'black boxes.' We know what they're supposed to do and what's supposed to go in and out, but no more."

Even in seven weeks, the group

Left — Lyn's husband Dave waits his turn to ride City Slicker. Above — Lyn and Kathy take a lunchtime stroll past construction at new Software Center.

The idea of a perfect program makes Lyn laugh. "There's no such thing," she says, "you can't have a program that's the best at everything."

can't possibly test a program for everything—that would take several lifetimes of around-the-clock effort —so they have to use a lot of judgment about what to check. "This was very difficult in the early days," says Lyn, "but now, we just concentrate on the new features."

That's more than enough to keep her group busy, because new features are constantly being added to No. 4 ESS software. This is one of the major virtues of all of our ESS systems: to change things, you don't have to build new hardware or do rewiring—you just change the software.

Lyn says she spends a typical day answering questions and teaching. Thanks to her experience and natural gregariousness, she does it well. "I'm sort of a resource for the whole ODA group, because I've worked on so many different parts of the project." With four years on the job, Lyn, like Kathy, is already an old timer in a group whose average age is in the twenties.

Of all her assignments so far, says Lyn, her present one has been the most difficult, because it called for totally different capabilities than she had ever needed before. "I needed leadership skills," she says, "and the only way you learn those is by doing them."

She has a theory that programmers like to do jigsaw puzzles. "Knowing a computer language is like having all the pieces of a puzzle and having to create a picture with them." In addition to being logical, thorough and patient, she feels a programmer also must be aggressive. "To do a really good job on a difficult program," she says, "you have to be ready to fight for it." She also feels that programs tend to be extensions of people's personalities, although there is far less of this now than there used to be.

She chuckles at the suggestion of a "perfect program." "There's no such thing. You can't have a program that's the best at everything. All programs are compromises. For example, you'll trade maintainability for a faster running program, or *vice versa* — you can't have both." By *maintainability* she means the ease with which a program can be altered or added to.

To Lyn, the most fascinating thing about computers is their accuracy. "It's nice to know if something isn't working right, it's something *you* did and not the machine. I get irritated when the press blames computers for mistakes or failures. The great majority of bugs are people bugs."

Asked if she understands how computers work, she replied, "Well, I couldn't wire one up, but I've had a lot of courses on computer hardware, and anytime I can't understand something, I ask my husband." Obviously, Dave has the answers. She gave him a microprocessor chip for their first anniversary, and he's been building a computer in their garage ever since. She doesn't know what they'll do with it when it's finished either.

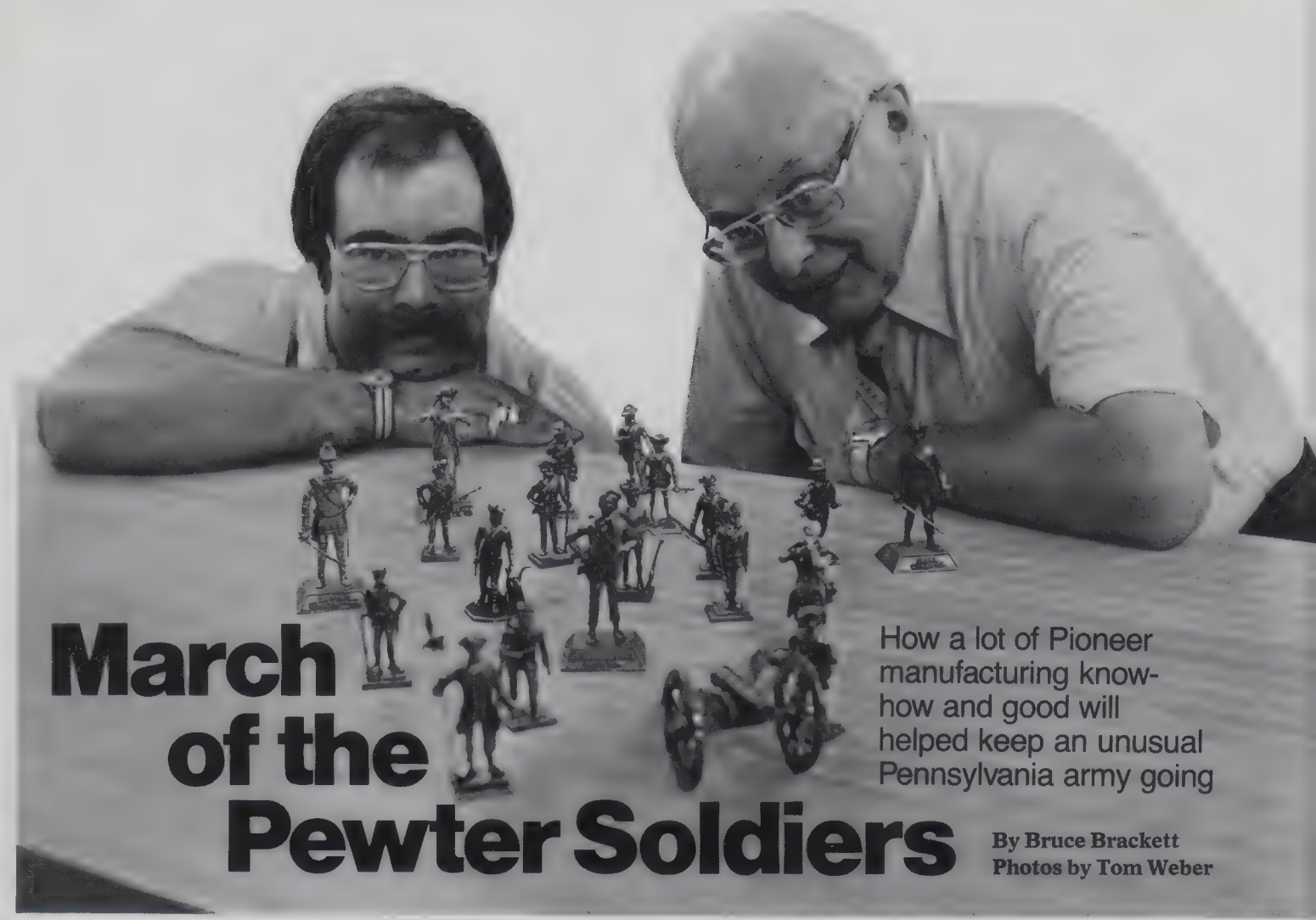
In addition to computers, the Weavers share another common interest. Both are avid equestrians and own their own horse, City Slicker. In time, they hope to become regulars at fox hunting—though Lyn is quick to explain it won't be with live foxes. "We drag a sack with fox scent around for the dogs." So far she has hunted only with borrowed horses, since City Slicker is too young and inexperienced.

Music is another of Lyn's major interests. She plays the guitar and sings madrigals with a Bell Labs choral group. Like many people, she feels music and programming have something in common — something she calls, "structured creativity." She is convinced that some people are born programmers, and some are not. "Their minds don't click the right way," she explains, hastily adding that "it has nothing to do with intelligence."

Like Kathy, she would like to move toward management sometime in the future, but is happy with the technical side of software for the time being.

For Lyn and Kathy, Joyce has nothing but the highest praise. "You've seen two of our very best people," she says. "What they are doing is crucial. Since their jobs were created, the quality of our product has always been above standard and all of our development schedules have been met."

She is equally positive in her view of what lies ahead for software. "It's the future of the Bell System," she says. "Even when the No. 4 ESS hardware market declines, we'll be able to sell customers new software features. Software gives us the capability of enlarging our market." WE



March of the Pewter Soldiers

How a lot of Pioneer manufacturing know-how and good will helped keep an unusual Pennsylvania army going

By Bruce Brackett
Photos by Tom Weber

Allentown retiree Charlie Nichter (right) and a student from the Devereux Pewter workshop review the troops in Devon, Pennsylvania.

A detachment of the King's 8th Regiment left Devon, Pennsylvania one night, bound for duty on Mackinac Island, Michigan.

The townsfolk in Devon never saw the regiment leave. They never heard the artillery pieces rumble past the fieldstone houses of this old Main-Line community in the suburbs of Philadelphia.

Quiet maneuvers by Revolutionary War units are common in Devon. Since the soldiers are cast in pewter and stand only a few inches high, their departures by Parcel Post don't attract much attention—except at the Edward L. French Vocational Rehabilitation Center run by The Devereux Foundation.

Pewter cannons, mini-muskets and an astounding variety of meticulously researched scale-model soldiers are produced in the center's new pewter shop by mentally handicapped adolescents and young adults.

These solid curios are merchandised as Devereux Pewter. Most of them are sold to the National Park Service for sale at historic sites, such as Valley Forge, Gettysburg and Independence Hall in Philadelphia. The King's 8th detachment had been dispatched for sale at a state park in Michigan.

The French Center is one of 25 facilities operated around the country by the Devereux Foundation, which has been operating therapeutic programs for children and adults since it was formed 70 years ago. Most of the young people working in the pewter shop live in nearby residences also run by the Foundation. During the day they spend on campus they also go to classes, receive psychological and social counseling and get whatever help the Foundation can provide.

One of the few things the Foundation couldn't provide was manufacturing expertise. The pewter operation had originally been a sideline business of a New Jersey man who ran it with three part-time workers. After Devereux leased it for a year and then bought it, 21 youngsters were working in the shop along with four staff members.

Business was good, but unfortunately Devereux Pewter was becoming a victim of its own success. Orders became backlogged. Cost control became more difficult during the transition into what students and staff considered large-scale manufacturing.

Fifty five miles away at the Allentown Works of Western Electric there was a concentration of people whose knowledge of pewter may have been shaky, but there was very little they didn't know about running an efficient manufacturing organization.

Late last year the problems of the non-profit workshop came to the attention of Lyle Hentz, an engineering manager at Allentown. He arranged for a team of engineers and accountants from the Works to look over the Devereux workshop and make some basic recommendations. After these recommendations were in, the job of helping Devereux Pewter into the world of modern manufacturing was taken over by a crew of expert consultants—recruited from the ranks of retirees who were members of the Allentown Council of the Telephone Pioneers of America. The first group of Pioneers brought over 200 man-years of manufacturing experience to the workshop.

Charlie Nichter, a retired cost accountant and production supervisor from Allentown, heads this voluntary consultant effort which has been sending Pioneers to Devereux an average of twice a week since last February.

At the recommendation of the Pioneers, the layout of the workshop was changed to permit a more efficient flow of work. That flow begins when the molds are inserted into a molding machine and molten pewter is ladled into a ceramic funnel. Rough edges are pruned away by hand. Then the item is plated with an antiquing solution to give it the look of old-time pewter. Devereux's soldier-makers manufacture their own molds.

Lou Kukoda, director of the French Center, said the Pioneer consultants won over his staff and the students by listening to their problems and assessing the situation carefully before offering advice. The advice was welcome and heeded.

"On the plus side, we had a good quality product at a reasonable price, but we needed help with just about everything," Kukoda said.

Lou Kukoda, director of the Edward L. French Vocational Rehabilitation Branch of the Devereux Foundation, watches work in progress at the shop.

And the Pioneers have offered help with just about everything. Cost controls, worker safety, production efficiency, packaging. There was always a Western retiree with experience and knowledge to share. At first glance, the work experience of these Pioneer volunteers might seem far removed from the needs of a pewter shop. But the manufacturing principles aren't that different whether you're working with molten pewter or ceramic substrates.

"The product engineering concerns here are pretty much the same as they were with Western Electric at Allentown," explained Bill Nelson, a retired engineer who has helped the workshop select and arrange new equipment. "The thinking and the process are the same. The problem is to get set up right the first time, and that's what we're trying to do for them now."

Norm Schaffer was a packaging engineer during his active days at Western Electric. He's very proud of designing the packaging for Telstar satellite components. Now he has just designed a new die-cut cardboard package for Devereux Pewter's Concord Minutemen, who had been suffering high casualties in transit.

Norm's testing methods for all his package designs at Devereux are slightly more simplified than during his days at Allentown, but every bit as effective. He just mails a package from Devon to his home in Emmaus, Pa. If the product arrives unbroken, he considers his package design a success.

Other Life Member consultants to the pewter shop are Ralph Mueller, Phil Portz, Ed Stahley, Don Hill, Willard Otto, Larry Walter and Charles "Gus" MacKenzie.

The whole Devereux Pewter operation is beginning to experience success, too. On the recommendation of the Pioneers, the Foundation purchased new equipment. Western was able to donate some surplus equipment, notably a curing oven that cut down the time required to make a mold from three days to one.

Devereux's backlog of orders is being whittled away. Breakage is down, efficiency is up. As encouraging as that is, the real success of the Edward L. French Vocational Rehabilitation Center is not in making products, but in making better lives for people.

The pewter shop and other workshops at the center, managed by Bill Delahanty, are part of a comprehensive program of counselling, education and therapy. Workshops do provide some income, and students are paid for their work, but the real payoff is in the doing. Younger students, called clients by the center, learn to adjust to the demands of a workplace. They develop work habits and self-discipline which will enable some to go on to more advanced vocational training and eventually outside employment.

Nobody can put a process like that on a precise schedule with guaranteed results. But by converting Devereux Pewter into an efficient manufacturing concern, the Allentown Pioneers can help. That's enough to keep them coming back to Devon. WE

Western Electric's cost-reduction program is a major weapon in the war against inflation

Each dollar we earned or saved or spent in 1975 is now worth roughly two thirds that much.* The money we try to save is getting harder to hold onto as prices for food, clothing, fuel, and other necessities seem to be rising faster than our income. Americans are more conscious than ever of the need to reduce costs, to economize, and to create ways to stretch dollars back to their former value.

The uncertain economy that has played havoc with personal finances has affected corporations in much the same way. The producer price index (once known as the wholesale price index) for industrial commodities has increased 60 percent since 1975. In particular, the cost of energy (fuels, related products, and power) for industrial users has increased 134 percent since 1975, and 473 percent since 1967.

What these statistics say is that it costs Western Electric a lot more for raw materials, supplies, components, fuels, chemicals, plastics, metals, and machinery. Quite simply, it is more important than ever to find and monitor cost-effective manufacturing techniques.

At Western, we've been doing something about rising costs through the cost-reduction program. Long before inflation became a household word—and worry—Western had its cost-reduction system in place. Millions of dollars have been saved through this program over the years. It is one reason why the cost of telephone service has increased at a substantially slower rate than the cost of other consumer goods and services.

*All statistics are from *Economic Report of the President*: Transmitted to Congress January 1981.

Western's cost-reduction program—finding new and more economical ways of doing things—is an established part of doing business. Through it, results are measured, analyzed, and studied. The program itself costs money, and for that reason, its scope, size, and rigorous procedures are monitored closely.

Before any ideas for cost reductions can be fully investigated a feasibility study is conducted to estimate the savings and the expenditures for the coming five years. These estimates are compared to the out-of-pocket expenditures for the case to determine comparative profitability in order to choose projects with the greatest rate of return for the company's investment.

When a project that shows promise is found, a formal case is prepared and submitted to the local cost-reduction committee by the engineers who proposed it. If it proves worthwhile, the idea is put into practice. The minutes of these committee meetings are circulated to all of Western's locations to avoid duplication of effort as well as to inform other engineers for possible application at other locations.

But what about quality? That's a major consideration in any cost-reduction case. Many of the recent cost reductions are based on technological developments which help to save money and sometimes even enhance the product's versatility. The quality of Western's products is designed in at the beginning—that's the beauty of our relationship with Bell Labs. The Labs must approve all changes made in the design of a product. In addition, each of our plants has a quality-assurance group that reports independently on our products. These controls make ours one of the most sophisticated cost-reduction programs in the industry.

In the 1980 Annual Report, as in

past reports, a section was devoted to engineering cost reductions. Cost reductions in 1980, made possible by finding more efficient ways of producing products, resulted in about $295 million in first-year savings. That's a new record for the program. A small sampling of the hundreds of cases that made 1980 a record year are covered here.

Circuit-Pack Assembly at Montgomery

At the Montgomery Works, the assembly process for data set circuit packs has evolved from hand operations to very sophisticated computer-controlled machine operations which are almost fully automatic. This assembly process streamlines the product flow, uses computer-controlled automatic and semi-automatic machines, numerically controlled hand-assembly stations, automatic conveyors and wave-solder machines, numerically controlled lead-trimming machines, and an automatic defluxing machine that removes flux residue and cleans and lubricates the gold finger-type terminals.

Automatic assembly has resulted in a significant reduction in assembly defects. In 1980, another study was made to determine if the visual screening operation for components could be reduced or elimi-

Rodney Griffin (left) and William Swenson look on as Norma O'Conner screens a circuit pack for component and solder defects.

nated. After a careful review of the visual-screening process as it was then carried out, Rodney B. Griffin and William A. Swenson, both planning engineers for facilities and processes in data set circuit-pack manufacturing at Montgomery, found that the visual screening process duplicated screening effort that was no longer required. Further, some of the screening that required partial disassembly of the circuit packs could be done prior to assembly.

Griffin and Swenson developed new screening instructions for circuit-pack products that eliminated duplication and the need for disassembly. In some cases they found sample screening to be adequate.

All of this is expected to provide $1.0 million in savings in the first year.

New Repeater Case for SLC*-96 System

While Western is primarily the manufacturing unit of the Bell System, the group at Springfield is responsible for engineering, quality, and marketing of products purchased from suppliers outside the Bell System. Western is one of the nation's largest consumers, purchasing over $5 billion in supplies each year. Engineers at Springfield are responsible for the design and development of purchased products and manufacturing processes at outside supplier facilities.

Above — (left to right) William Garnell, Steve Kokulak, Mike Suriani, and Ken Johnson of Springfield discuss the design of the new repeater case for the SLC-96 and other carrier systems.

At the Purchased Product Engineering facility in Springfield, New Jersey, two engineers—Bill Garnell and Ken Johnson—incorporated a new metals-casting technique on repeater cases and achieved a $5.4 million cost reduction. The year was 1976 and that case was the largest in PPE's history. (See *WE* July/August 1977.)

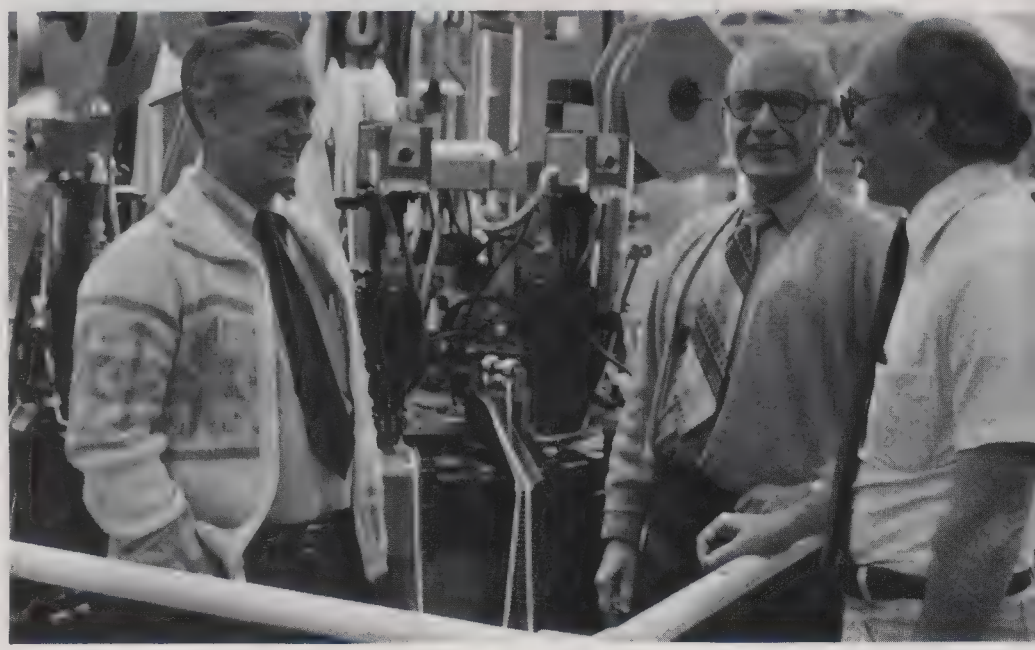
In 1980, Garnell and Johnson teamed up with Mike Suriani and Steve Kokulak, also in the engineering group at Springfield. These four achieved outstanding results for PPE. This time, the savings to Western total approximately $6.4 million, which represents the largest cost reduction at any of Western's locations in 1980. The new cost reduction is the result of the design of a new repeater case that is smaller, lighter, and better suited than the heavier cast-iron cases to the requirements of the subscriber loop carrier systems. Their new repeater case has a plastic housing for ease of manufacture and incorporates features that facilitate maintenance by the operating companies.

The newly designed repeater cases are to be used with the new SLC-96 system and other carrier systems using T1-type carrier equipment. These repeaters restore and amplify the multiplexed voice and data signals as they are transmitted over trunk cables. It is expected that approximately 10,000 cases will be manufactured on an annual basis.

Johnson has been involved in the two biggest cost-reduction cases in PPE's history. "I have a sense of pride," he says, "seeing a project on which I have worked become a reality. Western gave us a chance to make our good ideas materialize."

Trimming Costs at Indianapolis

A cost saving of $1.3 million was realized at the Indianapolis Works in the assembly process of the Trimline® telephone. The savings resulted from the design and installation of machines to carry out critical assembly processes that were initially done largely by hand. Engineers Ed Raus and Allen Glaubke designed a process and the necessary machinery to insert components into printed wiring boards in the Trimline phones. Although components have been inserted automatically in other printed wiring boards, the Trimline telephone network requires flexible boards, which have been considered unsuit-



*Trademark of Western Electric

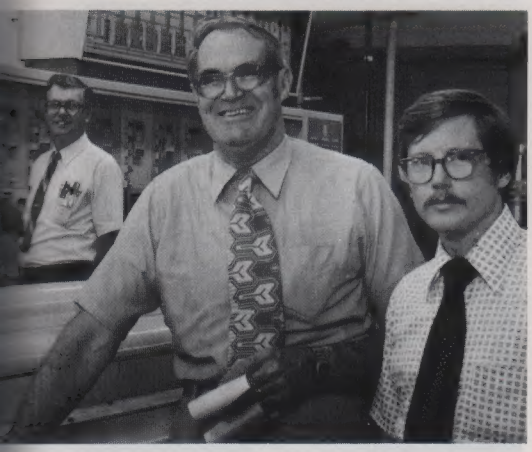
able for automatic insertion.

The new machines at Indianapolis simultaneously cut, form, and insert six electrical components. The machines eliminate handling, conveyorize many of the operations, and produce higher quality products that require fewer repairs at the end of the line.

Saving Gold in Dallas

Here's a cost-reduction case that actually occurred at Dallas, but is typical of the kind of thing going on at many Western Electric locations. When the price of gold began to climb several years ago, it became increasingly important to watch its use and to safeguard against the slightest waste.

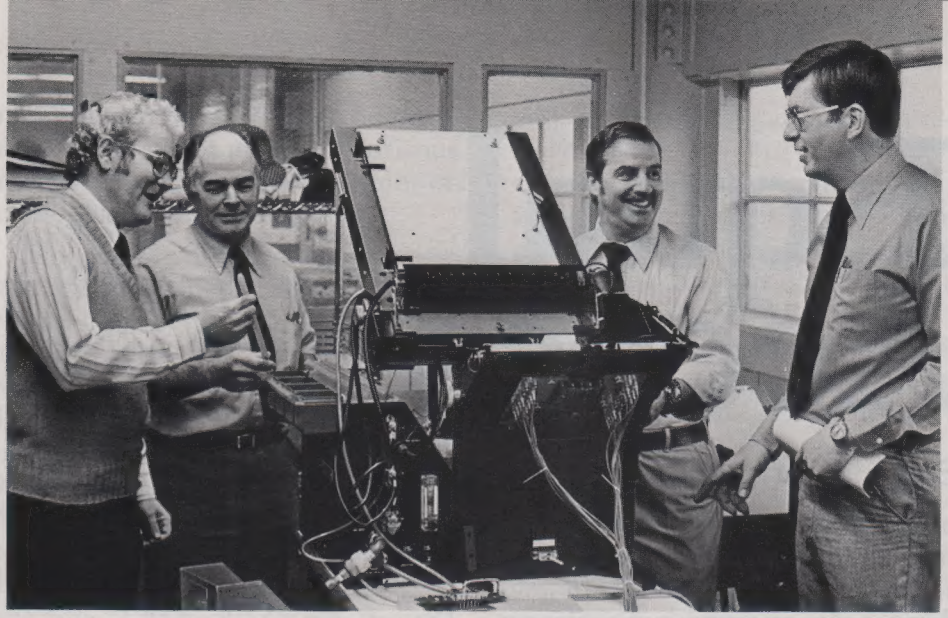
At the suggestion of Bell Labs, engineers from the Dallas Works—Bill Evarts, Pat Smith, Dick Mont-



Above — (left to right) Dick Montgomery, Bill Evarts, and Pat Smith at work in the gold-plating room.

gomery and Bruce Gibbs — presented a cost-saving idea that involved reducing the amount of gold plating on the contact and backplane ends of the 947K connector terminals from 125 microinches and 100 microinches respectively to 50 microinches. They reasoned that if they could reduce the gold requirement and still meet the design requirements and practical porosity specifications on the connectors,

Left — (left to right) Ed Raus, Allen Glaubke, and Ron Pride exchange views about the Trimline® telephone cost reduction of $1.3 million at Indianapolis.



Western could save a considerable amount in gold purchases.

A microinch is one millionth of an inch. The microscopic amounts of gold represented by 50 or 75 microinches may not seem like a great deal—they are too small to be seen—but, in the process of producing millions of connectors each year, enormous savings can result.

After working with Bell Labs to test the connector's efficiency, the gold reduction on the contact end was approved and is now being implemented throughout Western. The current-level savings that resulted from this case totalled more than $2.5 million.

Greater Yields on Memory Chips at Allentown

At Allentown, engineers from the chip manufacture and packaging groups — Frank Clarke, Bob Whitner, Tony LaPadula, and Alex Mackiewicz—joined forces to maximize yields and reduce delicate hand work in the production of a 65,536 bit semi-conductor memory device, known as the 34A Dynamic Random Access Memory (RAM).

These RAM chips are manufactured on wafers of silicon that have been chemically and thermally treated and each single wafer contains about 150 individual circuits when the processing has been completed. Because of the minute size of features on the chips and the complexity of the process, they are susceptible to defects introduced during the more than 130 different manufacturing operations.

Above — The teamwork of (left to right) Frank Clarke, Bob Whitner, Tony LaPadula, and Alex Mackiewicz produced a cost reduction at Allentown of $9.0 million.

"As far as chip design," Whitner says, "we identified problems with the electrical performance and the chip layout. Specific processes seemed to be limiting the yield of the chips. With the cooperation of engineers from Bell Labs, we analyzed the production operation to highlight the specific factors that were limiting yields." The team then improved the manufacturability of the product and more than tripled the chip yield per wafer.

In the packaging area, semi-automatic package handlers were developed for the test set to allow one operator to run up to three sets at once. The Allentown engineers were able to improve productivity by establishing routines for fewer operators and by devising more reliable ways to test the chips.

This cost-reduction case resulted in a $9.0 million savings.

Western's cost-reduction program is just one part of the effort to keep costs down and productivity up. Cost consciousness is more than counting dollars and cents. To Western's engineers, it is a dedicated pursuit for quality and the most productive way of manufacturing products. It's a combination of good thinking and careful planning that produces opportunities for reducing costs. It means better service and better products for our customers. WE

Equal Access

Employment on the basis of abilities

Above—Charlie Pradel continues to practice "signing" with Becky Fedio in order to maintain fluency.

Becky Fedio glows with mischievous laughter as she recounts how she broke her arm several years ago in a snowmobiling spill. Fedio, a ten-year veteran at the Allentown Works, now works in one of the clean rooms there. Her story is similar to many athletic-accident stories —but it proved to have larger implications. For many people, a broken arm is a broken arm. For Becky Fedio, however, a broken arm interferes with her ability to communicate because she is deaf and relies on the American Manual Alphabet and sign language in the same way other people rely on speech.

Fedio's broken arm set Charlie Pradel, a fellow shop employee and a chief union steward of local 1522 at Allentown, to work on what has become a second part of his job at the Works. Pradel, a 21-year veteran, explains, "First, Becky arranged for me to learn signing, which is a system of hand gestures for communicating by the hearing impaired. Then she took the time to practice with me. I've been signing since Becky's fall — it's an art — and I spend a significant part of my time here at the Works as an interface between some of the hearing-impaired employees and other employees, supervisors, well, anybody. For me it's a whole new aspect to my job—an aspect I especially enjoy."

The United Nations has designated 1981 the International Year of Disabled Persons (IYDP). The theme of the year is *full participation and equality* for disabled persons in the social life and development of the societies in which they live. The U.S. Council for IYDP, AT&T, and the other 200 corporate partners in this effort are working to break down attitudinal, technological, and architectural barriers that keep so many disabled people from joining the mainstream of society. There are 36 million physically or mentally disabled people in the United States. Of those who are of working age and not institutionalized, a full 50 percent are unemployed.

Western is working to reduce that figure. Paul Matt, General Manager of Corporate Engineering, Plant Design and Construction, initiated a program in 1979 throughout the Company to make physical modifications on all of Western's facilities so that they would be accessible to and usable by disabled individuals, be they applicants, employees, or vendors.

The Architectural Barrier Removal Plan, as the program is called, outlines the objective and the priorities for implementation of the plan. Matt asserts that the plan is an "essential adjunct to the Company's affirmative action program to recruit, employ, advance in employment, and otherwise treat qualified disabled individuals without discrimination." He adds, "The emphasis at Western is on abilities rather than on disabilities."

The "access path" concept was adopted to provide a barrier-free path marked by the International Wheelchair Symbol, from the street, in parking areas, into the building, and within the employment or personnel office. The modifications included the installation of ramps, alteration of curbing for wheelchair access, parking spaces reserved for disabled employees, relocation of public telephones, modification of drinking fountains, and modification of rest-room facilities.

In the past few years, as a result of these structural changes as well

Below—Becky Fedio's newest job assignment is in the bipolar silicon-integrated-circuit clean room.

as a new awareness and sensitivity to the needs of employees who have disabilities, there has been a marked increase in the number of disabled individuals who work for Western. From word processors to clean-room operators, from chemists to graphic designers, there are now many Western employees who probably once believed their horizons might be limited and perhaps not include full-time jobs or careers.

The new sensitivity and awareness are fully evident at Allentown, where, in addition to structural modifications for the employees who use wheelchairs, a program has been developed to promote "equal access to communication" for the hearing-impaired employees. Charlie Pradel and Becky Fedio, needless to say, have been in on it since the beginning.

Mary Jo Falco, an EO associate, outlines the history of the "equal access" program. "During a presentation to the employees in 1980 by Howard Loar, Allentown's General Manager, Charlie interpreted the remarks into sign language for two deaf employees." Following the presentation, a special session was held for all hearing-impaired employees. Works Director of Manufacturing Ted Tyler delivered the remarks while Charlie signed.

Above—Allentown Works employee Ken McHenry uses one of the plant's modified drinking fountains.

After that meeting, Pradel, the training department, and the EO department developed a plan to hold meetings for the hearing-impaired employees. These meetings are held twice each quarter during times when shifts overlap, so that there are no time conflicts.

"We've retained the services of a professional interpreter," Falco adds. "Charlie's good, and I'm also learning to sign—but being able to sign and being able to interpret using speech and signs are two different skills." Falco, who took a course to learn signing and is also learning from practicing with Fedio, refers to signing as a challenging new language—similar to the foreign language in which she majored in college.

Falco continues, "I'm available in the EO office to discuss job-related problems, to interview hearing-impaired applicants, and to work with the training organization to make the quarterly meetings worthwhile for the employees. We show films or invite speakers, and we always allow time for questions and answers about the Company. A teletypewriter has been installed in the medical department, and the nurses have been trained to use it so that the hearing-impaired employees and their families can communicate with the Works, in case of illness, emergency, or whatever. A second teletypewriter is planned for the cafeteria. It's not that we treat the disabled employees any differently from other employees. The "equal access" program is just that—an effort to get the same information about the Company and from the Company across to all of the employees. Our work with the hearing-impaired is just one facet of Allentown's total effort to meet the needs of all handicapped employees."

Looking ahead Falco says, "Right now, we're working on an evacuation plan that will go into effect in 1982 for the employees who have indicated that they would need assistance during an emergency. It's all part of a concerted effort—one that seems to be company-wide in scope—to make accommodations in order to employ disabled individuals. Our efforts here have had management backing all the way. We're proud that Allentown is getting a reputation for its "equal access" program. It benefits all of us—and makes Allentown and by extension, all of Western—a better place to work." WE

Believe it or not, there is a Western Electric employee underneath this makeup. Can you guess the role he's playing? Turn to page 14 to find out who he is and what he really looks like.

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